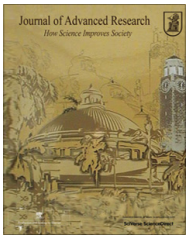
Journal of Advanced Research (2013) 4, 569

Cairo University

Journal of Advanced Research



BOOK REVIEW

A Review of the book entitled: A source book in the fundamentals of classical and statistical thermodynamics

This book of *Thermodynamics* is designed to arouse the interest of the students in beginners or advanced levels and encourage them to advance and develop systematic and thorough treatment of the fundamental principles of the subject.

The *Kinetic theory of gases* which was developed by Clausius, Maxwell and Boltzmann, has expanded nowadays too widely and has developed into another theory, namely *The Atomic Theory of the Properties of Matter in Bulk*. This theory has in turn bifurcated into two other theories: (i) *The Theory of the Properties of Matter in Equilibrium*, and (ii) *The theory of Transport Phenomena*. The former branch is referred to as *Statistical Mechanics*.

This way of approach has led to a new branch of thermodynamics which is called *Statistical Thermodynamics*. This branch might therefore be regarded as a possible link between pure thermodynamics and pure statistical mechanics. On this basis, the introduction of the atomic structure of matter into thermodynamics has been achieved in this book by the following procedure:

First, a brief account of *Elementary Wave Mechanics or Schroedinger's Mechanics*, together with some of its applications to the rotations of molecules and nuclei has been given. For the sake of simplicity the algebra used in this account is that of one-dimensional system.

Second, comprehensive account of Quantum Statistics using Bose–Einstein and Fermi–Dirac Statistics and also of *Maxwell–Boltzmam Classical Statistics*, is outlined.

Statistical thermodynamics differs from classical thermodynamics in that the thermodynamic functions for the assemblies and phases with which the author deals always constructed *a priori* by the application to particular molecular models of the fundamental theorems of statistical mechanics. In this way new formulations of the laws of classical thermodynamics are achieved.

Statistical methods are also extended in brief to *Chemical Reactions*, *Fluctuations*, and *Irreversible Thermodynamics*.

As regards the *entropy* in classical thermodynamics, an introduction of this concept is considered as the essential function of the *Second Law of Thermodynamics*. Subsequently, for a proper understanding of entropy utilizing the theorems of classical thermodynamics only, the author have proceeded, in conformity with other authors, from *Carnot's heat engine* and reversible cyclic processes. This approach leads to the essential property of the entropy as a function of state. In this connection it may be pointed out that by using the entropy concept, Lord Kelvin (in 1848) was able after making his *porous-plug experiment with Joule, to realize his suggested Absolute Sale of Temperature*, as shown in this book.

On the other hand, *Boltzmann's approach* to the entropy concept using statistical thermodynamics views the entropy as a measure of disorder, and defines it as the number of ways by which a particular *macrostate* can be realized.

The order of this book is cited by the publisher as the 24th among various international books in the thermodynamics, the 1st being that of E. Schrödinger (Nobel Laureate, 1933).

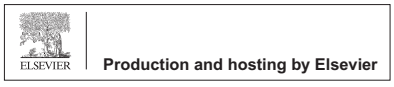
Some of the references the author used in writing his book are cited in the preface of the book.

Finally, as one of the most appropriate test books in thermodynamics for under- and post-graduates, this book is highly recommended.

Hanna A. Rizk
Chemistry Department, Faculty of Science, Cairo University, Giza, Egypt

Available online 25 July 2013

Peer review under responsibility of Cairo University.



http://dx.doi.org/10.1016/j.jare.2013.06.008